Swiping away your alcohol problem: A feasibility study of a mobile alcohol avoidance training.

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Abstract

Background: Alcohol use is associated with the automatic tendency to approach alcohol, with the retraining of this tendency (cognitive bias modification, CBM) showing therapeutic promise in clinical settings. To improve access to the training and to enhance participants' engagement, a mobile version of the Alcohol Avoidance Training was developed.

Objective: The aims of this pilot study were to assess 1) adherence to the m-health application, 2) changes in weekly alcohol use from pre to post training and 3) user experience with regard to the m-health application.

Methods: A self-selected, non-clinical sample of 1082 participants, experiencing problems associated with alcohol, signed up to use the Alcohol Avoidance Training app, Breindebaas, for three weeks with at least 2 training sessions per week. Each training session consisted of a total of one hundred pictures: 50 of alcoholic beverages, and 50 of non-alcoholic beverages were presented consecutively in a random order, in the center of the touchscreen. Alcoholic beverages were swiped upwards (away from the body), whereas the non-alcoholic beverages were swiped downwards (towards the body). During approach responses, the picture size increased to mimic an approach movement, and conversely picture size decreased during avoidance responses to mimic avoidance. At baseline we assessed sociodemographic characteristics, alcohol consumption, alcohol-related problems, use of other substances, self-efficacy and craving. After three weeks, 410 (38%) participants (post-test responders) completed an online questionnaire evaluating adherence, alcohol consumption and user satisfaction. Three months later, 206 (19%) participants (follow-up responders) filled in a follow-up questionnaire examining adherence and alcohol consumption.

Results: The 410 post-test responders were older, more commonly female and higher educated than post-test dropouts. Of those who completed the study, 79% were considered adherent having completed 4 or more sessions, while 58% performed the advised 6 training sessions or more. The study showed a significant reduction in alcohol consumption of 7.8 units per week after three weeks (95%CI [6.2,9.4]; P<.001; n=410) and another reduction of 6.2 units at three months for the follow-up responders (95%CI [3.7,8.7]; P<.001; n=206). Post-test responders expressed positive feedback regarding the fast working, simple and user-friendly design of the app. Almost half of the post-test responders reported to have gained more control over their alcohol use. The repetitious and non-personalized nature of the intervention were suggested as points for improvement.

Conclusions: The current study was one of the first to employ the Alcohol Avoidance Training as a mobile application for problem drinkers. Preliminary findings suggest that a mobile CBM app fulfils a need for problem drinkers and may contribute to a reduction in alcohol use. Replicating these findings in a controlled study is warranted.

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Abstract

Background: Alcohol use is associated with the automatic tendency to approach alcohol, with the retraining of this tendency (cognitive bias modification, CBM) showing therapeutic promise in clinical settings. To improve access to the training and to enhance participants' engagement, a mobile version of the Alcohol Avoidance Training was developed. **Objectives:** The aims of this pilot study were to assess 1) adherence to the m-health application, 2) changes in weekly alcohol use from pre to post training and 3) user experience with regard to the m-health application. **Methods:** A self-selected, non-clinical sample of 1082 participants, experiencing problems associated with alcohol, signed up to use the Alcohol Avoidance Training app, Breindebaas, for three weeks with at least 2 training sessions per week. Each training session consisted of a total of one hundred pictures: 50 of alcoholic beverages, and 50 of non-alcoholic beverages were presented consecutively in a random order, in the center of the touchscreen. Alcoholic beverages were swiped upwards (away from the body), whereas the non-alcoholic beverages were swiped downwards (towards the body). During approach responses, the picture size increased to mimic an approach movement, and conversely picture size decreased during avoidance responses to mimic avoidance. At baseline we assessed sociodemographic characteristics, alcohol consumption, alcohol-related problems, use of other substances, self-efficacy and craving. After three weeks, 410 (38%) participants (post-test responders) completed an online questionnaire evaluating adherence, alcohol consumption and user satisfaction. Three months later, 206 (19%) participants (follow-up responders) filled in a follow-up questionnaire examining adherence and alcohol consumption. **Results**: The 410 post-test responders were older, more commonly female and higher educated than post-test dropouts. Of those who completed the study, 79% were considered adherent having completed 4 or more sessions, while 58% performed the advised 6 training sessions or more. The study showed a significant reduction in alcohol consumption of 7.8 units per week after three weeks (95%CI [6.2,9.4]; P<.001; n=410) and another reduction of 6.2 units at three months for the follow-up responders (95%CI [3.7,8.7];

P<.001; n=206). Post-test responders expressed positive feedback regarding the fast working, simple and user-friendly design of the app. Almost half of the post-test responders reported to have gained more control over their alcohol use. The repetitious and non-personalized nature of the intervention were suggested as points for improvement. **Conclusions:** The current study was one of the first to employ the Alcohol Avoidance Training as a mobile application for problem drinkers. Preliminary findings suggest that a mobile CBM app fulfils a need for problem drinkers and may contribute to a reduction in alcohol use. Replicating these findings in a controlled study is warranted.

Introduction

Problematic alcohol use is one of the most prevalent health problems in modern life. It has several negative personal, social and economic consequences [1-4]. When not addressed properly and timely, problematic alcohol use can result in an alcohol use disorder (AUD). Regular treatment of AUD and support for reducing problematic alcohol use, like Cognitive Behavioral Therapy (CBT) and Motivational Interviewing (MI), primarily focus on influencing controlled cognitive mechanisms. Although these treatments have proven to be effective [5,6], long-term outcomes still remain modest [7]. To achieve progress in the effectiveness of treatments, research should further investigate the role played by relatively automatic processes. The dual process model [8,9] integrates both the relatively slow, reflective processes as well as the fast, impulsive processes.

Cognitive Bias Modification (CBM) programs have been developed to influence these impulsive processes, by for example changing biases in action tendencies [10]. Research demonstrates that problem drinkers have an approach-bias for alcohol-related stimuli [11]. Different CBM programs have been developed to directly influence the approach bias, e.g. the Stimulus Response Compatibility (SRC) task [11] where participants are required to make a symbolic approach/avoidance movement to pictures, or the Alcohol Avoidance Training, which is an adapted version of the Alcohol Approach Avoidance Task (A-AAT) [12]. In the Alcohol Avoidance Training, participants respond to either alcoholic or non-alcoholic pictures of beverages on a screen, by “pulling towards” or “pushing away” the pictures using a joystick or keyboard. An important feature of the Alcohol Avoidance Training is the zooming function, that follows the pushing or pulling movement, creating the sensation of the beverage moving either away or towards the user. Using Alcohol Avoidance Training has shown positive results in a clinical setting [13], where receiving four sessions of Alcohol Avoidance Training displayed a long-term clinical effect on alcohol-dependent patients (n=214) when added to their regular treatment. This study, as well as a large replication study (n=509) [14], illustrated significant reductions in relapse a year after treatment

(respectively 13% and 10%) in the CBM condition compared to a placebo condition. This effect was found to be mediated by the change in approach-tendencies in the latter study [15]. Additionally, a recent study comparing different combinations of approach bias and attention bias retraining to 'sham' or no training with 1405 alcohol-dependent patients rendered a somewhat smaller, but significant result, showing an average of 8.4% higher success rate 1 year after treatment, but did not confirm the mediating effect of the change in approach tendencies on the outcome. [16] Nowadays, most bias modification training programs are offered in a laboratory setting, clinical setting or online via a computer. Although transferring treatment from a face-to-face to a mobile setting could be accompanied by lower patient engagement and higher dropout rates [17], online training programs can alsoelicit the advantage that participants can use the intervention independently of time and place [18], thus making it particularly suitable for outpatient treatment. For example, Wiers et al. (2015) conducted a web based CBM study on self-selected problem drinkers (n=136). Participants in the different conditions (including the control condition) of the study reduced their alcohol intake by 2.31 to 9.94 units per week [19]. However, having to log on to a computer or laptop for every training session may hinder motivation to train [20]. As most adults use a smartphone or tablet daily [21], and other forms of CBM training are operated by a joystick or keyboard, offering CBM training on a mobile device is an intuitive next step. Delivering CBM training this way facilitates more frequent training, as it allows participants to perform each session anywhere, anytime and may therefore promote engagement. A small study by Boendermaker and colleagues (2015) found support for this assumption, as participants (young and regular drinkers, not specifically selected on the basis of their motivation to reduce their drinking behavior) appeared to be more involved with CBM training when using a smartphone version of the CBM training compared to those training on a computer [22]. Until now, however, little is known about the use and evaluation of mobile CBM training in people who are willing to change their drinking behavior.

In the present study, a smartphone/tablet version of an Alcohol Avoidance Training was tested among a self-selected sample of Dutch problem drinkers from the general population. The aims of this study were to 1) measure adherence to the mobile Alcohol Avoidance Training, 2) determine the change in weekly alcohol use from pre to post training and 3) assess user experience.

Methods

Design

This pilot study consisted of a single group design with three measurements: a baseline measurement, a post-intervention assessment at three weeks, and a three-month follow-up assessment. The study was approved by the ethics committee within the faculty of Behavioral Management & Social Sciences of the University of Twente.

Participants

Participants were recruited between the 10th and 23rd of November 2016, via free publicity in national and regional newspapers, and on radio stations and television. A total of 1214 participants signed up for the study. To be included, participants had to: 1) be willing to reduce/stop their drinking or be concerned about their drinking; 2) be aged 18 years or older; 3) have access to and ability to use the internet via a smartphone or tablet; 4) have the ability to read and write in Dutch; 5) sign (online) informed consent.

Intervention

The Breindebaas app (see figure 1) is a mobile version of the Alcohol Avoidance Training [13,14] which is an adapted version of the Approach Avoidance Task [23]. The mobile version distinguishes itself from the original (joystick operated) and online (keyboard operated) version of the Alcohol Avoidance Training by: 1) using swiping movements on the screen, directly touching the picture and swiping it away with a finger, and 2) by asking the participant to re

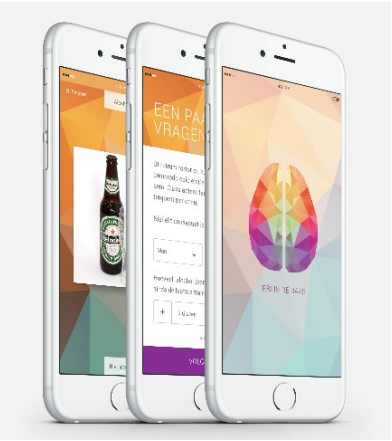


Figure 1. Example of Breindebaas app

picture (relevant feature) instead of the orientation of the picture (irrelevant feature). Every session contained 100 pictures (drinks only, without context) from the Amsterdam Beverage Picture Set [24], half of which depicted alcoholic beverages and the other half as non-alcoholic beverages. Participants were instructed to respond to these pictures by swiping away the alcoholic beverages and swiping the non-alcoholic beverages towards them. Participants were encouraged to swipe as quickly and accurately as possible. If a mistake was made, such as reacting too slowly or not completing the 'swipe movement' correctly, participants would receive a short error notification (in word and sound) with instructions. When swiping correctly, a sound notified users of their correct response. After every 20, 50 and 80 pictures, participants received an encouraging message on the screen of their device, such as "you're well on your way" or "almost there!". These messages were included to motivate participants to complete their training session. Between every two pictures, there was a 1-second time interval. The time interval between an encouraging message and the next picture was 2 seconds. After every session, the participant received an overview of their score regarding their average time and percentage of correct responses.

Measures

Table 1 displays an overview of the characteristics and measures assessed at baseline, post-assessment and follow-up. Internal consistency of scales was inspected with Cronbach's-α, with values equal to or greater than 0.7 being considered as acceptable [25].

Sociodemographic characteristics

Participants reported their gender, birth date, source of income, daily occupation, educational level and smartphone/tablet information (type, brand, model).

Alcohol consumption

The Dutch adaptation [26] of the self-report Timeline Follow Back (TLFB) procedure [27] was used to assess alcohol consumption. Participants indicated the number of standard units of alcohol consumed throughout each day over the past week. The total score of the scale was calculated by the

total sum of all 7 days [27]. TLFB is a much used retrospective estimation measure, also used with similar target groups [28], with adequate validity [29].

Alcohol related problems

The 10-item Dutch version [30] of the Alcohol Use Disorders Identification Test (AUDIT) [31] was used to assess drinking behaviors and alcohol-related problems. Internal consistency in the current sample was acceptable with Cronbach's alpha of .80.

Use of other substances

Participants were asked about their prior use over the past year, as well as current use, of other substances (tobacco, cannabis, cocaine, LSD, amphetamines, XTC, GHB, opiates, benzodiazepines, other).

Drinking Refusal Self-efficacy

Items of the Drinking Refusal Self Efficacy Questionnaire (DRSEQ) [32] were used to assess the three dimensions of self-efficacy in relation to refusal of alcohol, as identified by Young et al. [33]: social pressure, emotional relief and opportunistic drinking. The original DRSEQ contains a total of 31 items for these 3 dimensions, and has shown good psychometric quality, both for the subscales and for the total scale (Cronbach's alpha > 0.8) [34]. For the current study, a short measure of self-efficacy was constructed using 3 items from both the dimension of social pressure and emotional relief, and 2 items from the dimension of opportunistic drinking, representing the items that were most relevant for our study. Cronbach's alpha for these 8 items was .90 in the current sample.

Craving

Using the 5 items scale [35] of the original 14 items Obsessive Compulsive Drinking Scale (OCDS) [36], participants were asked to rate their thoughts, feelings and actions concerning alcohol. Cronbach's alpha in the current sample was .74.

Adherence

Adherence was measured by recoding the self-reported number of sessions. Participants were advised to complete at least 6 training sessions; these were established as the mean optimum in a study by Eberl et al. [37]. In our study, completing 4 or more of the advised six training sessions was considered as adherent, as research by Wiers et al. (2011) has previously shown this to have a significant effect [13].

User satisfaction

The client satisfaction regarding the CBM Alcohol Avoidance Training was assessed using the Dutch version of the 8 item Client Satisfaction Questionnaire (CSQ) [38]. Cronbach's alpha was 0.91.

User experience

Participants were invited to answer several questions about their experience with the Breindebaas app. Questions concerned its overall impression, benefits and drawbacks in using the app, suggestions for future development, main reason behind using the app, technical problems, use of other alcohol intervention treatments during the intervention period, place of using the app (e.g. at home, at work or in the pub), and intention to continue using the app in the future. Lastly, participants were questioned on concentration, which was measured by simply inquiring about participant's general concentration during a training session, on a 4-point scale (not concentrated at all – very much concentrated), converted to a dichotome variable (1-2: not concentrated ; 3-4: concentrated) for analyses. At follow-up, participants were asked whether they had kept on using the app and their reasoning behind this decision. They were also asked whether they used other forms of help associated with their alcohol use during throughout the research period.

Table 1. Characteristics and measures at baseline, post-assessment and follow-up.

	baseline	Post-assessment	Follow-up

Sociodemographics	√		
TLFB	√	√	√
AUDIT	√		
Other substances	√		
OCDS	√		
DRSEQ	√		
CSQ		√	
User Friendliness		√	
Treatment history		√	√
Use of app + reasons		√	√

TLFB= Time Line Follow Back, AUDIT= Alcohol Use Identification Test, OCDS= Obsessive Compulsive Drinking Scale, DRSEQ= Drinking Refusal Self Efficacy Questionnaire, CSQ= Client Satisfaction Questionnaire

Procedure

Participants were referred to a website [39], where information about the study and the app was provided. Participants who demonstrated an interest were then asked to fill out a digital informed consent form and an online baseline questionnaire. Upon completion, instructions for downloading the app as well as an access code needed for using the app were provided digitally. Participants were requested to complete at least 2 training sessions every week for 3 weeks, leaving at least 24 hours between two sessions. Three days after completing a session, participants received an alert that a new training session was available. If participants did not finish a training session within 5 days, a reminder was sent via push message. Optionally, participants could choose to receive these messages via SMS. The link to the post-assessment questionnaire was sent via email three weeks after the start of the training. Participants were not given specific instructions to keep on using the app after the post-assessment. Three months after completing the post-assessment questionnaire, participants were asked to fill out a follow-up questionnaire. A reminder was sent by email or SMS one week later. By completing all three questionnaires, participants had the chance of winning one of five available gift

vouchers, each worth 100 euros.

Statistical analysis

Descriptive statistics were used to describe the baseline characteristics of the participants and the characteristics of the those who completed the training at post-test. Means and standard deviations (SD), or the median and interquartile range (IRQ), were provided dependent on the normality distribution for continuous variables. Categorical variables were presented as numbers with corresponding percentages. Independent-samples t-tests or Wilcoxon rank sum tests (continuous variables) and chi-square tests or Fisher Exact tests (categorical variables) were used to compare baseline characteristics between post-test responders and post-test dropouts, as well as between follow-up responders and follow-up dropouts. A paired samples t-test was performed in order to compare the alcohol consumption at baseline and post-test. Linear regression analysis was performed to identify any predictors correlated to change in alcohol consumption between baseline and post-test. Variables associated ($p \leq .15$) in univariate analysis were all entered into the multivariate model, and subsequently eliminated step by step based on significance (backward elimination method).

The change in alcohol consumption from baseline to post-assessment at three weeks and to the follow-up assessment three months later was analyzed using a mixed model analysis. In case of significant changes over time, Sidak post-hoc analyses were performed to test which measurements were statistically significantly different. All tests were performed with SPSS version 24.0.

Results

Baseline characteristics

In total, 1238 participants completed the baseline questionnaire. Of these, 156 participants were excluded due to their age <18 years (n=2), not signing the informed consent (n=22), duplicated records (n=3), or having a ‘non-alcohol related reason’ to participate (n=129), e.g. professional

interest in the app. Thus, only 1082 participants were included for analysis at baseline. Table 2 demonstrates the baseline characteristics of the 1082 participants. The sample contained slightly more male participants (58%), with an overall mean age being 49.9 years old (SD=11.3) The mean weekly alcohol consumption was 36.6 standard units (SD=24.5). 93.5% of the participants reported an AUDIT score equal to or greater than 8, indicating problematic alcohol use throughout the vast majority of the sample.

Post-test responders and adherence

Of the original 1082 participants, 410 participants (38%) completed the post-intervention assessment (referred to as post-test responders), with 206 participants (19%) also completing the follow-up assessment after three months (referred to as follow-up responders). Post-test responders (n=410) and post-test dropouts (n=672) were compared on baseline characteristics (Table 2). Post-test responders were significantly older, less often male, elicited higher educational backgrounds and consumed less alcohol. This was mainly caused by the lower consumption of alcohol by females in the completers' group. Furthermore, post-test responders had lower AUDIT scores, both in males and females, and lower DRSE scores, mainly in males. Finally, post-test responders used fewer other substances.

Table 2

baseline characteristics and differences in baseline characteristics between post-test responders (n=410) and post-test dropouts (n=672)

Variable	Total *(n=1082)*		Post-test responders (n=410)		Dropout (n=672)		Analysis *t* value / X^2	*P*
Age (years), mean (SD)	49.89	(11.32)	52.4	(10.2)	48.3(11.7)	5.80	<.001*	
Gender, n (%)							6.14	.01*
Male	632	(58.4)	220	(53.7)	412	(61.3)		
Female	450	(41.6)	190	(46.3)	260	(38.7)		
Employed, n (%)	726	(70.9)	271	(70.6)	455	(71.1)	0.03	.86
Education, n (%)							26.60	<.001*
High[1]	583	(57.0)	257	(66.8)	326	(51.1)		
Middle[2]	286	(28.0)	91	(23.6)	195	(30.6)		
Low[3]	154	(15.1)	37	(9.6)	117	(18.3)		
Weekly alcohol consumption, mean (SD)	36.6	(24.5)	33.3	(21.8)	38.7	(25.8)	-3.69	<.001*
Male	42.4	(26.5)	40.0	(24.7)	43.7	(27.3)	-1.71	.09
Female	28.5	(18.7)	25.5	(14.4)	30.7	(21.0)	-3.08	.00*
AUDIT, mean (SD)	17.2	(6.7)	15.8	(6.1)	18.0	(6.9)	-5.27	<.001*
Male	18.2	(6.3)	17.1	(6.0)	18.8	(6.5)	-3.13	.00*
Female	15.7	(6.8)	14.4	(5.9)	16.7	(7.3)	-3.71	<.001*
DRSE, mean (SD)	25.4	(7.4)	24.8	(7.4)	25.8	(7.3)	-2.17	.03*
Male	25.0	(7.3)	24.1	(7.3)	25.4	(7.3)	-2.21	.03*
Female	26.0	(7.4)	25.6	(7.5)	26.4	(7.3)	-1.06	.29
OCDS, mean (SD)	5.3	(3.2)	5.2	(3.0)	5.4	(3.3)	-1.31	.19
Other substances, n (%)	452	(41.8)	141	(34.4)	311	(46.3)	14.8	<.001*
Tobacco	338	(31.2)	100	(24.4)	238	(35.4)	14.41	<.001*
Benzodiazepines	142	(13.1)	45	(11.0)	97	(14.4)	2.67	.10
Cannabis	108	(10.0)	24	(5.9)	84	(12.5)	12.52	<.001*
Other	209	(19.3)						

[1] University of Research or University of Professional Education
[2] Higher General Secondary Education or Intermediate Vocational Education
[3] Primary school or Lower Vocational Education

*p<0.05 (2-tailed)

TLFB= Time Line Follow Back, AUDIT= Alcohol Use Identification Test, OCDS= Obsessive Compulsive Drinking Scale, RCQ= Readiness to Change Questionnaire, CSQ= Client Satisfaction Questionnaire

In a similar analysis among the 410 participants remaining in the study at post-test, baseline characteristics were compared between the follow-up responders (n=206) and the follow-up drop-outs (n=204). A significant difference in baseline characteristics was found regarding the participant's age, demonstrating that the follow-up responders tended to be older (mean 55.2 vs 52.5, *P*=.01) and in their use of tobacco, where the follow-up responders smoked significantly less (n=63 (30.6%) vs n=78 (38.2%), *P*=.01). No other significant differences were found.

Participants reported the sessions they completed from 'one' to 'more than 10' in the questionnaire (Mdn: 6, IQR: 4-7). Of the 410 post-test responders, 323 (78.8%) participants completed 4 sessions or more, which was considered adherent in this study. Furthermore, 239 (58%) participants performed the recommended 6 sessions (n=123, 30%) or more (n=116, 28.4%). The main reasons for not completing the recommended number of sessions were 'it does not seem to help me' (21%) and 'not having enough time' (19%).

Concentration while performing a session was recoded into a dichotomous variable (concentrated, not concentrated). Of the 410 post-test responders, 375 (91.5%) reported to be concentrated throughout their training sessions.

Changes in alcohol consumption over time and predictors

The average alcohol consumption of the post-test responders (n=410) decreased significantly by 7.8 units per week (95%CI [6.2, 9.4]; *P*<.001), from baseline M=33.3 (SD=21.8) to post-assessment M=25.5, (SD=20.4).

Table 3 illustrates the results of the regression analyses, which evaluated the potential predictors of changes in alcohol use. The following variables were found to be univariately associated with a stronger decrease in alcohol consumption (*P*<.15): male gender, unemployment, higher level of baseline craving and a higher baseline AUDIT score, a higher level of self-reported concentration

during sessions, and a higher adherence. When these factors were entered in a multivariate regression model, only gender, adherence and craving remained significant predictors of change in alcohol consumption.

Table 3: univariate and multivariate linear regression coefficients, confidence intervals (CI) and significance levels of baseline characteristics on alcohol consumption

		Univariate Coefficient	95%CI	*P*	Multivariate Coefficient	95%CI	*P*
Gender							.01
	Male	9.92	[0.75 – 7.09]	.02	4.44	[1.36 -	
	Female	ref			ref	7.52]	
Concentration					-	-	-
	No	ref					
	Yes	6.74	[1.08, 12.40]	.02			
Adherence							
	No	ref			ref		
	Yes	5.69	[1.83, 9.55]	.00	6.09	[2.33, 9.85]	.00
Work situation					-	-	-
	unknown	ref					
	paid	1.54	[-2.06, 5.14]	.04			
	unpaid	6.67	[0.07, 13.27]	.01			
OCDS		1.15	[0.63, 1.68]	<.001	1.15	[0.64, 1.67]	<.001
AUDIT		0.05	[0.23, 0.75]	<.001	-	-	-

Changes in alcohol us at Follow-up

The subsample of 206 participants that completed the follow-up assessment displayed a significant reduction in alcohol use over time. Their average weekly alcohol consumption decreased from 31.6 (SD 23.2) units at baseline, to 24.4 (SD 19.2) at three weeks and to 18.2 (SD 17.3) units at follow-up three months later, resulting in a total decrease of 13.4 units a week. Pairwise comparisons in a mixed model analysis demonstrated the reductions for this subsample as significant, both from

baseline to post-assessment (mean difference = 7.2 CI [4.9, 9.6], *P*<.001), as well as from post-assessment to follow-up (mean difference = 6.2 CI 3.7, 8.7], *P*<.001).

A mixed model for repeated measurements, in which all 410 participants were taken into account, produced similar results (see Table 4). Pairwise comparisons in a mixed model analysis displayed the reductions also as significant, both from baseline to post-assessment (mean difference = 7.4 CI [5.7, 9.6], *P*<.001) and from post-assessment to follow-up (mean difference = 6.6 CI 4.2, 9.0], *P*<.001).

Table 4: Mean alcohol consumption at Baseline, Post-assessment and Follow-up using mixed models for n=206 and n=410

	Mean alcohol consumption (SE)			
Measurement	**N=206**		**N=410**	
Baseline	31.6	(1.6)	32.6	(0.9)
Post-assessment	24.4	(1.3)	25.2	(0.9)
Follow-up	18.2	(1.2)	18.6	(1.0)

User experiences

When asked about what post-test responders (n=410) gained from using the app over a three week period, almost half of the participants stated having the feeling of more control over their drinking (e.g. *gained more control over alcohol use, decided more frequently not to drink, chose to drink alcohol less automatically),* with many participants also reporting to be more aware of their alcohol use (36%). However, 194 participants (47%) reported that they gained nothing from using the app.

Post-test responders revealed an overall CSQ score of 20.9 (SD 4.4) with an average score of 2.6 on a scale from 1-4 (Item variances: 0.5), indicating moderate satisfaction. Participants were particularly positive about the simple and fast working, user-friendly design of the app. Criticism and subsequent suggestions about the app mostly targeted elements concerning *monotony* and *lack of personalization*. Participants deemed using the app as boring and monotonous, due to the repetition of the task and the pictures. They suggested introducing motivational elements, such as levels or ‘game options’, as well as a shorter interval between the swiping movements and the subsequent

picture. Thus, the introduction of a greater variation in pictures and the possibility of choosing pictures was suggested.

Of the 410 post-test responders, 318 (78%) participants had never sought help or used an intervention in order to reduce their alcohol use previously. Forty-six participants (11%) reported to have had extra help in reducing their alcohol use during the Breindebaas training period in the form of a self-help program, help from a GP, professional in (addiction) care or peer support. Twenty out of these 46 participants had never sought help before.

Of the 206 participants that completed the follow-up questionnaire, 85 continued to use the app. The main reasons behind this decision were that using the app helped them to be more conscious of their alcohol use (n=51) and it assisted in maintaining their reduced drinking habits (n=15). Of the 121 participants that stopped using the app, the main motives behind this were doubts regarding the app's effectiveness (n=40) and simply forgetting to use the app (n=33).

Discussion

The current study is, as far as we are aware, the first to evaluate a mobile version of the AAT training in a sample of problem drinkers in the general population. Given the debate on the effectiveness of CBM [40,41], it is essential to differentiate between experimental studies with students, set up to show that biases can be influenced (but do not always show a change in behavior), clinical trials with alcohol dependent patients who are motivated to change [42], and non-clinical problem drinkers from the general public. Gaining more insight into the feasibility and outcomes of CBM for the participants in this study (not clinically diagnosed with AUD, but are willing to change their drinking behavior), is therefore especially relevant.

The baseline characteristics, adherence to the intervention, change in alcohol consumption and user experiences were studied. Participants of this study were comparable to groups analyzed in previous research via web-based self-help interventions regarding their level of problematic alcohol use [42-44] and not actively looking for professional help in order to aid the reduction of their drinking behaviors [45,46]. The large group of problem drinkers interested in using the Breindebaas app given the short timeframe of the study pleasantly surprised us. It can be considered a strength that this low-threshold application seems to appeal to this hard-to-reach group, as it may reduce the stigma associated with directly meeting a professional [47].

The intervention adherence within the post-test responders group was high. A majority of the post-test responders (78.8%) used the app 4 times or more, doing better than an online CBM trial by Wiers on alcohol, where 44% of participants completed the prescribed 4 sessions [19]. The fact that the Breindebaas app is a mobile version of an AAT and therefore available to participants at any moment could be a particularly contributing factor. For example, a pilot study using a mobile CBM app on obesity found an 86% training session completion rate [48].

In this study, we observed a significant reduction in alcohol use among post-test responders

immediately after using the mobile intervention, and 3 months later. Although a reduction of 13 units per week is substantial for such a brief intervention, the results need to be seen in the context of a pilot study without a control condition to compare the findings with, especially given earlier observed main effects across CBM and control conditions [19]. Further research should be implemented, in which the app training should be compared in a controlled design with sham training. The same caution should be exercised with the impact of the predictors (gender, adherence and craving) that were established in order to change one's alcohol consumption.

Participants were mostly positive about the Breindebaas app. The simple, fast working, user-friendly design resulted in participants reporting more awareness and control over their alcohol use. Nevertheless, a considerable portion of participants also reported to have gained nothing from using the app. Reportedly, this was due to the repetitious and monotonous character of the AAT and its lack of personalization. Regarding the lack of personalization, participants mainly indicated that some of the pictures contained beverages, both alcoholic and non-alcoholic, that were not appealing to them at all. Wiers et al. (2018) already indicated that personalizing the alcohol-related stimuli would be a potential way forward [41]. Studies on CBM related to eating habits indicated that personalizing CBM tasks may increase attention, motivation and interest, and therefore also increase adherence [49,50]. An additional reason for withdrawing from using the Breindebaas app was the participant's questions and doubts pertaining the working mechanism behind the training. Other studies support this finding [20] which may mean that for the future development of similar tasks explaining the reasoning and the importance of repeated training is crucial.

A number of limitations must be addressed. Firstly, as this study was set up as a pilot study, with the aim to assess feasibility and adherence, no control group was allocated. Consequently, the change in self-reported alcohol consumption found in this study may well be the result of a placebo-effect of the app, or a non-specific effect of engaging in any intervention, or even of participating in

a study. As already mentioned, just reporting alcohol use alone can have an effect on the reduction of drinking [51]. Nonetheless, the change in alcohol consumption demonstrated by participants in this study seems large enough to justify future studies on the effectiveness of the Breindebaas app. Secondly, participants were invited to partake in this study via free publicity channels, and were only asked to provide basic information about themselves. As none of the present studies' participants were interacted with face-to-face, we must rely on their self-reporting. This, of course, could decrease the reliability of our results (though reliability of the measures was described as acceptable to good in the current study). Self-reported alcohol use reduction in subjects participating in treatment is likely to be positively biased, overestimating outcomes. Next to self-reporting, the fact that more than half of the participants who had originally signed up dropped out during the training period and only 19% completed the follow-up questionnaire, may have decreased the generalizability of the results. Compared to other online CBM studies on alcohol or smoking [19,52,53] the dropout attrition rate in this study was comparable. The most likely factors - given the design of the study – influencing the dropout rate (between baseline and follow-up) were: 1) ease of enrolment, 2) ease of dropout, 3) no personal contact via face to face or by telephone, 4) the intervention being fully paid for [54]. Finally, no approach bias measurement was taken before and after using the app. Therefore, it is unknown whether the approach bias of participants changed over time, nor whether this mediated the effect of training on alcohol use. Previous studies have indicated that relevant treatment effects of CBM on clinical outcomes almost always are accompanied by a decrease in cognitive bias [55,56]. A study by Eberl et al. (2013) showed that patients with a strong approach bias at baseline elicited the best results in decreasing their bias [14], while no overall approach bias was established in the sample. This might have to do with ambivalent stance that many patients with AUD hold with respect to alcohol [57]. Future developments in mobile CBM applications and research should therefore consider

incorporating bias measurements, providing more insight into the working mechanism of CBM in the subclinical population.

To summarize: several suggestions from users and researchers provide the following insights for future development of the breindebaas app: 1) using personalized stimuli in the app; 2) adding more information about the working mechanism and effects of CBM, increasing motivation; 3) including a bias measurement in the app, so participants progress in bias scores can be tracked; 4) adding motivational/gamification elements (for example: levels or rewards) in order to contribute to users' adherence to the application. Adding 'gamification' elements was mentioned by users of the breindebaas app and have shown promising results in other forms of cognitive training [22, 58]. Next to app-development, more research on the effects of using the breindebaas app, using controlled trials, is advised. One suggestion would be to conduct a three-armed study, in which participants are assigned to either training with the breindebaas app, a mobile intervention with self-monitoring and goal setting features, or a waiting list condition. As the breindebaas app contains a relevant feature approach avoidance training, developing a credible placebo version is very challenging. Using a different mobile intervention as a way to rule out non-specific effects seems like a pragmatic choice. Following up on the current research, approaching the same target group (problem drinkers from the general population) would be consistent. This present study was the first study in which the Alcohol Avoidance Training was adapted to a mobile application for problem drinkers. The user evaluation suggests that this CBM app fulfils a need for problem drinkers reluctant to seek clinical treatment, as the majority of the sample never sought out for help prior to the study and were mostly positive about using the app. Participants in this study reduced their alcohol intake by a total of 13 units per week. Although results should be interpreted cautiously due to the absence of a control group, using the CBM app may contribute to reducing alcohol use among those who experience problems associated with drinking.

References:

1. Beaglehole R, Bonita R. Alcohol: a global health priority. Lancet [Internet] Elsevier Ltd; 2009;373(9682):2173–2174. PMID:19560583

2. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 2009;373(9682):2223–2233. PMID:19560604

3. Anderson P, Baumberg B. Alcohol in Europe – Public Health Perspective [Internet]. Drugs Educ Prev Policy. 2006. PMID:11902214 ISBN:9279022415

4. Cargiulo T. Understanding the health impact of alcohol dependence. Am J Health Syst Pharm United States; 2007 Mar;64(5 Suppl 3):S5-11. PMID:17322182

5. Vasilaki EI, Hosier SG, Cox WM. The efficacy of motivational interviewing as a brief intervention for excessive drinking: A meta-analytic review. Alcohol Alcohol. 2006. p. 328–335. PMID:16547122

6. Magill M, Ray LA. Cognitive-Behavioral Treatment With Adult Alcohol and Illicit Drug Users: A Meta-Analysis of Randomized Controlled Trials. J Stud Alcohol Drugs [Internet] 2009;70(4):516–527. PMID:19515291

7. Riper H, Andersson G, Hunter SB, de Wit J, Berking M, Cuijpers P. Treatment of comorbid alcohol use disorders and depression with cognitive-behavioural therapy and motivational interviewing: A meta-analysis. Addiction 2014;109(3):394–406. PMID:24304463

8. Stacy AW, Wiers RW. Implicit Cognition and Addiction: A Tool for Explaining Paradoxical Behavior. Annu Rev Clin Psychol [Internet] 2010;6(1):551–575. PMID:20192786

9. Wiers RW, Teachman BA, De Houwer J. Implicit cognitive processes in psychopathology: An introduction. J Behav Ther Exp Psychiatry 2007;38(2):95–104. PMID:17112462

10. Wiers RW, Gladwin TE, Hofmann W, Salemink E, Ridderinkhof KR. Cognitive Bias Modification and Cognitive Control Training in Addiction and Related Psychopathology. Clin

Psychol Sci [Internet] 2013;1(2):192–212. [doi: 10.1177/2167702612466547]

11. Field M, Kiernan A, Eastwood B, Child R. Rapid approach responses to alcohol cues in heavy drinkers. J Behav Ther Exp Psychiatry 2008;39(3):209–218. PMID:17640615

12. Wiers RW, Rinck M, Kordts R, Houben K, Strack F. Retraining automatic action-tendencies to approach alcohol in hazardous drinkers. Addiction 2010;105(2):279–287. PMID:20078486

13. Wiers RW, Eberl C, Rinck M, Becker ES, Lindenmeyer J. Retraining Automatic Action Tendencies Changes Alcoholic Patients' Approach Bias for Alcohol and Improves Treatment Outcome. Psychol Sci [Internet] 2011;22(4):490–497. PMID:21389338

14. Eberl C, Wiers RW, Pawelczack S, Rinck M, Becker ES, Lindenmeyer J. Approach bias modification in alcohol dependence: Do clinical effects replicate and for whom does it work best? Dev Cogn Neurosci [Internet] Elsevier Ltd; 2013;4:38–51. PMID:23218805

15. Gladwin TE, Rinck M, Eberl C, Becker ES, Lindenmeyer J, Wiers RW. Mediation of Cognitive Bias Modification for Alcohol Addiction via Stimulus-Specific Alcohol Avoidance Association. Alcohol Clin Exp Res 2015; PMID:25623410

16. Rinck M, Wiers RW, Becker ES, Lindenmeyer J. Relapse prevention in abstinent alcoholics by cognitive bias modification: Clinical effects of combining approach bias modification and attention bias modification. J. Consult. Clin. Psychol. 2018; 86:12. PMID: 30507226

17. Schuster R, Pokorny R, Berger T, Topooco N, Laireiter AR. The advantages and disadvantages of online and blended therapy: survey study amongst licensed psychotherapists in Austria. JMIR, 2018 20(12). 30563817

18. Wykes T, Haro J M, Belli SR, Obradors-Tarragó C, Arango C, Ayuso-Mateos J L, ... Elfeddali I. Mental health research priorities for Europe. Lancet 2015 2(11). PMID: 26404415

19. Wiers RW, Houben K, Fadardi JS, van Beek P, Rhemtulla M, Cox WM. Alcohol Cognitive Bias Modification training for problem drinkers over the web. Addict Behav [Internet] Elsevier Ltd; 2015;40:21–26. PMID:25218067

20. Beard C, Weisberg RB, Primack J. Socially anxious primary care patients attitudes toward cognitive bias modification (CBM): A qualitative study. Behav Cogn Psychother 2012;40(5):618–633. PMID:22127022

21. Deloitte. Global Mobile Consumer Survey 2018. 2018;(November). PMID:504710187

22. Boendermaker WJ, Boffo M, Wiers RW. Exploring Elements of Fun to Motivate Youth to Do Cognitive Bias Modification. Games Health J [Internet] 2015;4(6):434–443. PMID:26421349

23. Wiers RW, Rinck M, Dictus M, Van Den Wildenberg E. Relatively strong automatic appetitive action-tendencies in male carriers of the OPRM1 G-allele. Genes, Brain Behav 2009;8(1):101–106. PMID:19016889

24. Pronk T, van Deursen DS, Beraha EM, Larsen H, Wiers RW. Validation of the Amsterdam Beverage Picture Set: A Controlled Picture Set for Cognitive Bias Measurement and Modification Paradigms. Alcohol Clin Exp Res 2015; PMID:26431117

25. Cicchetti D V. Guidlines, Criteria, and Rules of Thumb for Evalauting Normed and Standardized Assessment Instruments in Psychology. Psychol Assess 1994;6(4):284–290. [doi: 10.1037/1040-3590.6.4.284]

26. Wiers RW, Hoogeveen KJ, Sergeant JA, Gunning WB. High- and low-dose alcohol-related expectancies and the differential associations with drinking in male and female adolescents and young adults. Addiction 1997; PMID:9293046

27. Sobell LC, Sobell MB. Timeline Follow-Back. Meas Alcohol Consum 1992. [doi: 10.1007/978-1-4612-0357-5_3]

28. Deursen, van, D. S., Salemink, E., Hofmann, W., Boendermaker, W., Pronk, P., Smit, F., & Wiers, R. W. Executive functions and motivation as moderators of the relationship between automatic associations and alcohol use in problem drinkers seeking online help. Alcohol Clin Exp Res 2015 39, PMID: 26247799

29. Dulin PL, Alvarado CE, Fitterling JM, Gonzalez VM. Comparisons of alcohol consumption by timeline follow back vs. smartphone-based daily interviews. Addict Res Theory, 2017 25(3). PMID: 29170622

30. Schippers GM, DeJong CAJ, Lehert P, Potgieter A, Deckers F, Casselman J, Geerlings P. The Obsessive Compulsive Drinking Scale: Translation into Dutch and possible modifications. Eur Addict Res 1997; PMID:131

31. Babor T, Higgins-Biddle JC, Saunders JB, Monteiro MG. The Alcohol Use Disorders Identification Test: guidelines for use in primary care, second edition. Geneva World Heal Organ 2001;

32. Oei TPS, Hasking PA, Young RM. Drinking refusal self-efficacy questionnaire-revised (DRSEQ-R): A new factor structure with confirmatory factor analysis. Drug Alcohol Depend 2005;78(3):297–307. PMID:15893161

33. Young RM, Oei TPS, Crook GM. Development of a drinking refusal self-efficacy questionnaire. J Psychopathol Behav Assess 1991;13:1–15.

34. Young RM, Oei TPS. Drinking expectancy profile: a test manual. Behaviour Research and Therapy Centre, University of Queens-land, Australia.; 1996.

35. de Wildt WAJM, Lehert P, Schippers GM, Nakovics H, Mann K, van den Brink W. Investigating the Structure of Craving Using Structural Equation Modeling in Analysis of the Obsessive-Compulsive Drinking Scale: A Multinational Study. Alcohol Clin Exp Res 2005; PMID:15834215

36. Anton RF, Moak DH, Latham P. The Obsessive Compulsive Drinking Scale: A Self-Rated Instrument for the Quantification of Thoughts about Alcohol and Drinking Behavior. Alcohol Clin Exp Res 1995; PMID:7771669

37. Eberl C, Wiers RW, Pawelczack S, Rinck M, Becker ES, Lindenmeyer J. Implementation of

Approach Bias Re-Training in Alcoholism-How Many Sessions are Needed? Alcohol Clin Exp Res 2014; PMID:24164417

38. De Wilde EF, Hendriks VM. The client satisfaction questionnaire: Psychometric properties in a Dutch addict population. Eur Addict Res 2005; PMID:16110221

39. www.breindebaasapp.nl.

40. Cristea IA, Kok RN, Cuijpers P. The Effectiveness of Cognitive Bias Modification Interventions for Substance Addictions: A Meta-Analysis. PLoS One [Internet] 2016;11(9):e0162226. PMID:27611692

41. Wiers RW, Boffo M, Field M. What's in a Trial? On the Importance of Distinguishing Between Experimental Lab Studies and Randomized Controlled Trials: The Case of Cognitive Bias Modification and Alcohol Use Disorders. J Stud Alcohol Drugs [Internet] 2018;79(3):333–343. PMID:29885138

42. Saitz R, Helmuth ED, Aromaa SE, Guard A, Belanger M, Rosenbloom DL. Web-based screening and brief intervention for the spectrum of alcohol problems. Prev Med (Baltim) 2004; PMID:15475031

43. Koski-Jännes A, Cunningham JA, Tolonen K, Bothas H. Internet-based self-assessment of drinking-3-month follow-up data. Addict Behav 2007; PMID:16822619

44. Riper H, Kramer J, Conijn B, Smit F, Schippers G, Cuijpers P. Translating effective web-based self-help for problem drinking into the real world. Alcohol Clin Exp Res 2009; PMID:19413646

45. Hester RK, Lenberg KL, Campbell W, Delaney HD. Overcoming addictions, a Web-based application, and SMART recovery, an online and in-person mutual help group for problem drinkers, part 1: Three-month outcomes of a randomized controlled trial. J Med Internet Res 2013; PMID:23846588

46. Cunningham JA, Wild TC, Cordingley J, Van Mierlo T, Humphreys K. A randomized

controlled trial of an internet-based intervention for alcohol abusers. Addiction 2009; PMID:19922569

47. West R, Michie S. Development and evaluation of digital interventions in healthcare. London: Silverback Publishing; 2016. ISBN:9781912141029

48. Kakoschke N, Hawker C, Castine B, de Courten B, Verdejo-Garcia A. Smartphone-based cognitive bias modification training improves healthy food choice in obesity: A pilot study. Eur Eat Disord Rev 2018;26(5):526–532. PMID:23668839

49. Forman EM, Goldstein SP, Flack D, Evans BC, Manasse SM, Dochat C. Promising technological innovations in cognitive training to treat eating-related behavior. Appetite [Internet] Elsevier Ltd; 2018;124:68–77. PMID:28414042

50. Stice, E., Lawrence, N. S., Kemps, E., & Veling, H. Training motor responses to food: A novel treatment for obesity targeting implicit processes. Clinical psychology review 2016, *49*, 16-27.

51. Miller W, Brown J, Simpson T, Handmaker N, Bien T, Luckie L, Montgomery H, Hester R, Tongian J. What works? A methodological analysis of the alcohol treatment outcome literature. Handb Alcohol Treat approaches Eff Altern 1995. p. 12–44.

52. Elfeddali I, de Vries H, Bolman C, Pronk T, Wiers RW. A randomized controlled trial of Web-based Attentional Bias Modification to help smokers quit. Heal Psychol 2016; PMID:27505210

53. Wittekind CE, Lüdecke D, Cludius B. Web-based Approach Bias Modification in smokers: A randomized-controlled study. Behav Res Ther Elsevier Ltd; 2019 May 1;116:52–60. [doi: 10.1016/j.brat.2018.12.003]

54. Eysenbach G. The law of attrition. J Med Internet Res. 2005. PMID:15829473

55. Gladwin TE, Wiers CE, Wiers RW. Interventions aimed at automatic processes in addiction: considering necessary conditions for efficacy. Curr Opin Behav Sci. 2017. [doi: 10.1016/j.cobeha.2016.08.001]

56. Grafton B, MacLeod C, Rudaizky D, Holmes EA, Salemink E, Fox E, Notebaert L.

Confusing procedures with process when appraising the impact of cognitive bias modification on emotional vulnerability. Br J Psychiatry 2017;211(5):266–271. [doi: 10.1192/bjp.bp.115.176123]

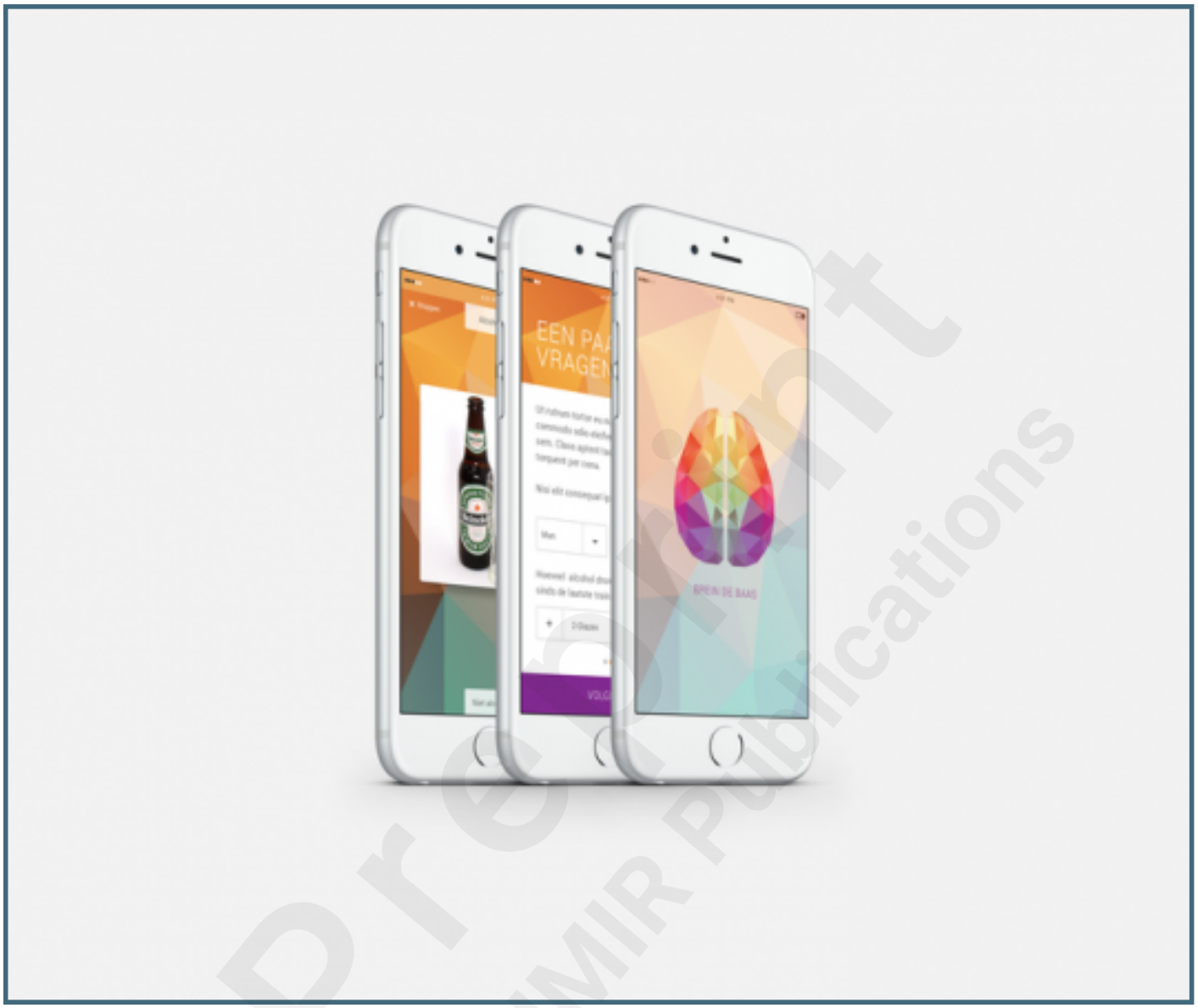
57. Barkby H, Dickson JM, Roper L, Field M. To Approach or Avoid Alcohol? Automatic and Self-Reported Motivational Tendencies in Alcohol Dependence. Alcohol Clin Exp Res 2012;36(2):361–368. PMID:21895719

58. Prins PJ, Brink ET, Dovis S, Ponsioen A, Geurts HM, De Vries M, Van Der Oord S. “Braingame Brian”: toward an executive function training program with game elements for children with ADHD and cognitive control problems. Games Health J. 2013 2(1). PMID: 26196554

Supplementary Files

TOC/Feature image for homepages

Breindebaas.



Figures

Example of the Breindebaas app.